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SANITARY SEWER STUDY

FOR
CITY OF LAWRENCE, KS
Police Department Facility
Overland Drive & Wakarusa Drive
Douglas County, KS

Prepared by:
Pat Kullberg, P.E.
McClure Engineering Company

January 21, 2019





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Project Description

The proposed project consists of a new building for the City of Lawrence Police Department at a site located northwest of the intersection of Overland Drive and Wakarusa Drive in the southwest quarter of Section 28-12-19 in the City of Lawrence, Douglas County, Kansas. The proposed building contains 56,516 square feet of floor area.

Design Criteria

The sanitary sewer calculations have been performed in accordance with the State of Kansas Department of Health and Environment Minimum Standards of Design for Water Pollution Control Facilities.

Sanitary Sewer Calculations

The proposed building will connect to the existing sewer manhole SW281219-004 located north of the proposed building as shown on Exhibit 1. The existing developed area draining to this manhole is 42.4 acres (Exhibit 2). The remainder of the drainage area tributary to this manhole is undeveloped. The proposed sanitary flow from the site is calculated based on actual water usage from a building that has a similar use. The water usage data is attached (Exhibit 3). The existing sanitary sewer flow to the receiving main has been calculated according to the attached table that is part of the KDHE design standards (Exhibit 4).

Existing Flow:

Commercial – (14.7 acres)(.0077 cfs/ac.) = 0.1132 cfs
Multi-Family Residential – (27.7 acres)(0.0084 cfs/ac.) = 0.2327 cfs
Total Existing Flow = 0.1132 + 0.2327 = 0.3459 cfs

Proposed Flow (Municipal Office Building) –

Average Daily Flow = (29 gpd/1000 SF)(56,516 SF) = 1,639 gpd
Peak Flow = (1,639 gpd)(3) = 4,917 gpd = 0.0076 cfs
Proposed flow is 2.2% of existing flow

Total Design Flow = 0.3459 + 0.0076 = 0.3535 cfs

Flow in existing 12” sewer at 0.64% slope (See Exhibit 5) –

Actual Depth = 0.24’
Actual Velocity = 2.47 fps
Velocity at 50% full = 3.63 fps
Full Flow Capacity = 2.85 cfs



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Summary and Recommendations

The project will increase the sewer flow to the existing main by 0.0076 cfs (2.2%). The proposed depth of flow is less than 67% of full flow depth and the velocity is in excess of 2 fps. The existing main is in accordance with KDHE design criteria and we recommend that the proposed building be allowed to connect to the existing sewer main as proposed.

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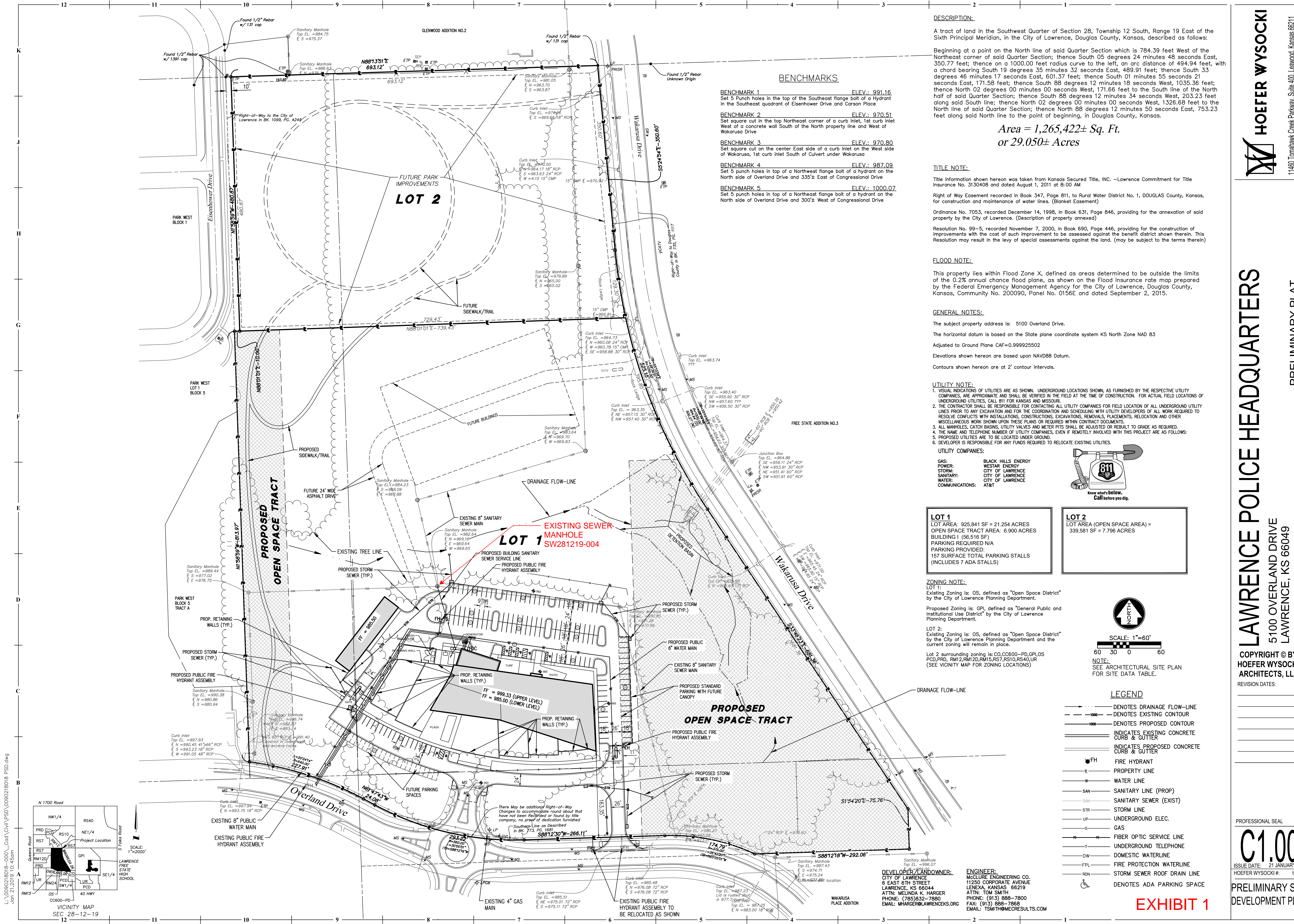
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Appendix



DESCRIPTION:
 A tract of land in the Southwest Quarter of Section 28, Township 12 South, Range 19 East of the Sixth Principal Meridian, in the City of Lawrence, Douglas County, Kansas, described as follows:
 Beginning at a point on the North line of said Quarter Section which is 784.39 feet West of the Northeast corner of said Quarter Section; thence South 05 degrees 24 minutes 48 seconds East, 350.77 feet; thence on a 1000.00 foot radius curve to the left, an arc distance of 494.94 feet, with a chord bearing South 19 degrees 35 minutes 32 seconds East, 489.91 feet; thence South 33 degrees 46 minutes 17 seconds East, 601.37 feet; thence South 01 minutes 55 seconds 21 seconds East, 171.58 feet; thence South 88 degrees 12 minutes 18 seconds West, 1035.36 feet; thence North 02 degrees 00 minutes 00 seconds West, 171.66 feet to the South line of the North half of said Quarter Section; thence South 88 degrees 12 minutes 34 seconds West, 203.23 feet along said South line; thence North 02 degrees 00 minutes 00 seconds West, 1326.68 feet to the North line of said Quarter Section; thence North 88 degrees 12 minutes 50 seconds East, 753.23 feet along said North line to the point of beginning, in Douglas County, Kansas.

**Area = 1,265,422± Sq. Ft.
 or 29.050± Acres**

- BENCHMARKS**
- BENCHMARK 1** ELEV.: 991.16
Set 5 Punch holes in the top of the Southeast flange bolt of a Hydrant in the Southeast quadrant of Eisenhower Drive and Carson Place
 - BENCHMARK 2** ELEV.: 970.51
Set square cut in the top Northeast corner of a curb inlet, 1st curb inlet West of a concrete wall South of the North property line and West of Wakarusa Drive
 - BENCHMARK 3** ELEV.: 970.80
Set square cut on the center East side of a curb inlet on the West side of Wakarusa, 1st curb inlet South of Culvert under Wakarusa
 - BENCHMARK 4** ELEV.: 987.09
Set 5 punch holes in top of a Northwest flange bolt of a hydrant on the North side of Overland Drive and 335± East of Congressional Drive
 - BENCHMARK 5** ELEV.: 1000.07
Set 5 punch holes in top of a Northeast flange bolt of a hydrant on the North side of Overland Drive and 300± West of Congressional Drive

TITLE NOTE:
 Title information shown hereon was taken from Kansas Secured Title, Inc. -Lawrence Commitment for Title Insurance No. 3130408 and dated August 1, 2011 at 8:00 AM
 Right of Way Easement recorded in Book 347, Page 811, to Rural Water District No. 1, DOUGLAS County, Kansas, for construction and maintenance of water lines. (Blanket Easement)
 Ordinance No. 7053, recorded December 14, 1998, in Book 631, Page 846, providing for the annexation of said property by the City of Lawrence. (Description of property annexed)
 Resolution No. 99-5, recorded November 7, 2000, in Book 690, Page 446, providing for the construction of improvements with the cost of such improvement to be assessed against the benefit district shown therein. This Resolution may result in the levy of special assessments against the land. (may be subject to the terms therein)

FLOOD NOTE:
 This property lies within Flood Zone X, defined as areas determined to be outside the limits of the 0.2% annual chance flood plane, as shown on the Flood Insurance rate map prepared by the Federal Emergency Management Agency for the City of Lawrence, Douglas County, Kansas, Community No. 200090, Panel No. 0156E and dated September 2, 2015.

GENERAL NOTES:
 The subject property address is: 5100 Overland Drive.
 The horizontal datum is based on the State plane coordinate system KS North Zone NAD 83
 Adjusted to Ground Plane CAF=0.999925502
 Elevations shown hereon are based upon NAVD88 Datum.
 Contours shown hereon are at 2' contour intervals.

UTILITY NOTE:
 1. VISUAL INDICATIONS OF UTILITIES ARE AS SHOWN. UNDERGROUND LOCATIONS SHOWN, AS FURNISHED BY THE RESPECTIVE UTILITY COMPANIES, ARE APPROXIMATE AND SHALL BE VERIFIED IN THE FIELD AT THE TIME OF CONSTRUCTION. FOR ACTUAL FIELD LOCATIONS OF UNDERGROUND UTILITIES, CALL 811 FOR KANSAS AND MISSOURI.
 2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING ALL UTILITY COMPANIES FOR FIELD LOCATION OF ALL UNDERGROUND UTILITY LINES PRIOR TO ANY EXCAVATION AND FOR THE COORDINATION AND SCHEDULING WITH UTILITY DEVELOPERS OF ALL WORK REQUIRED TO RESOLVE CONFLICTS WITH INSTALLATIONS, CONSTRUCTIONS, EXCAVATIONS, REMOVALS, PLACEMENTS, RELOCATIONS AND OTHER MISCELLANEOUS WORK SHOWN UPON THESE PLANS OR REQUIRED WITHIN CONTRACT DOCUMENTS.
 3. ALL MANHOLES, CATCH BASINS, UTILITY VALVES AND METER PITS SHALL BE ADJUSTED OR REBUILT TO GRADE AS REQUIRED.
 4. THE NAME AND TELEPHONE NUMBER OF UTILITY COMPANIES, EVEN IF REMOTELY INVOLVED WITH THIS PROJECT ARE AS FOLLOWS:
 5. PROPOSED UTILITIES ARE TO BE LOCATED UNDERGROUND.
 6. DEVELOPER IS RESPONSIBLE FOR ANY FUNDS REQUIRED TO RELOCATE EXISTING UTILITIES.

UTILITY COMPANIES:

GAS:	BLACK HILLS ENERGY
POWER:	WESTAR ENERGY
STORM:	CITY OF LAWRENCE
SANITARY:	CITY OF LAWRENCE
WATER:	CITY OF LAWRENCE
COMMUNICATIONS:	AT&T



LOT 1
 LOT AREA: 925,841 SF = 21.254 ACRES
 OPEN SPACE TRACT AREA: 6,900 ACRES
 BUILDING I (56,516 SF)
 PARKING REQUIRED N/A
 PARKING PROVIDED:
 157 SURFACE TOTAL PARKING STALLS
 (INCLUDES 7 ADA STALLS)

LOT 2
 LOT AREA (OPEN SPACE AREA) = 339,581 SF = 7.796 ACRES

ZONING NOTE:
 LOT 1:
 Existing Zoning is: OS, defined as "Open Space District" by the City of Lawrence Planning Department.
 Proposed Zoning is: GPI, defined as "General Public and Institutional Use District" by the City of Lawrence Planning Department.
 LOT 2:
 Existing Zoning is: OS, defined as "Open Space District" by the City of Lawrence Planning Department and the current zoning will remain in place.
 Lot 2 surrounding zoning is: C0,CC600-PD,GPI,OS PCD,PRD, RM12,RM15,R5,R510,R540,UR (SEE VICINITY MAP FOR ZONING LOCATIONS)



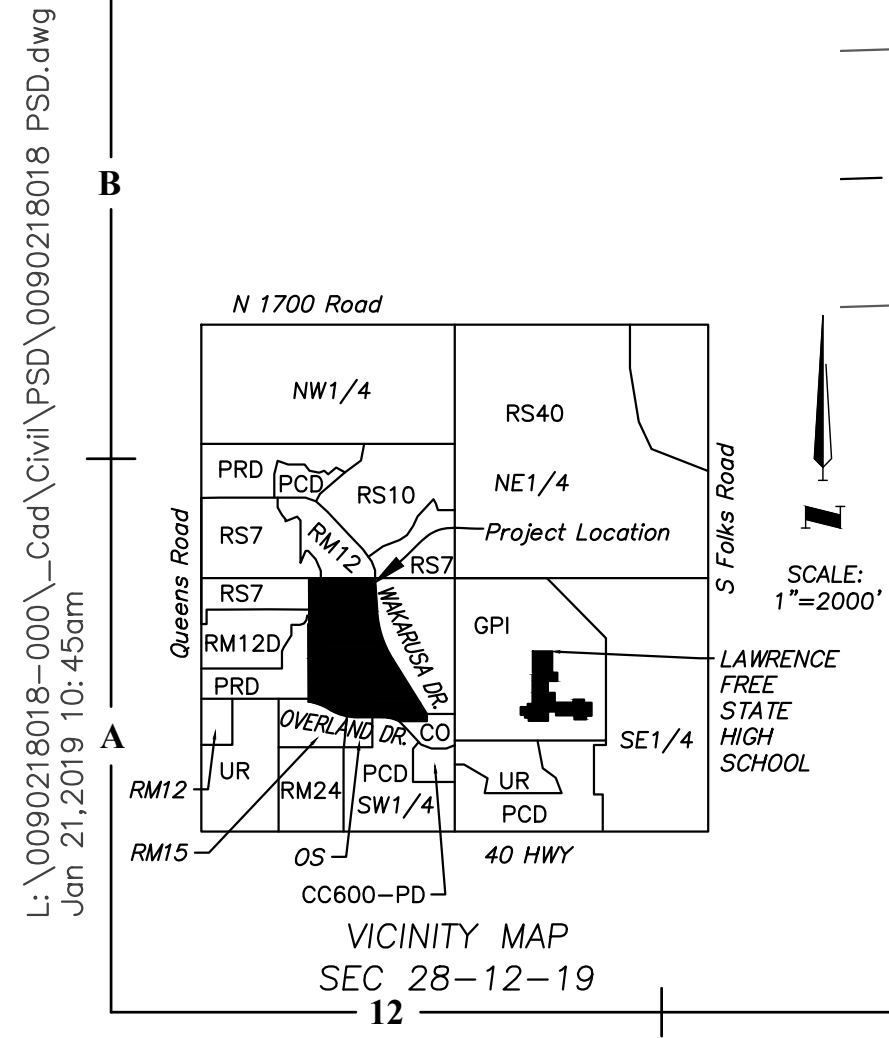
SCALE: 1"=60'

NOTE:
 SEE ARCHITECTURAL SITE PLAN FOR SITE DATA TABLE.

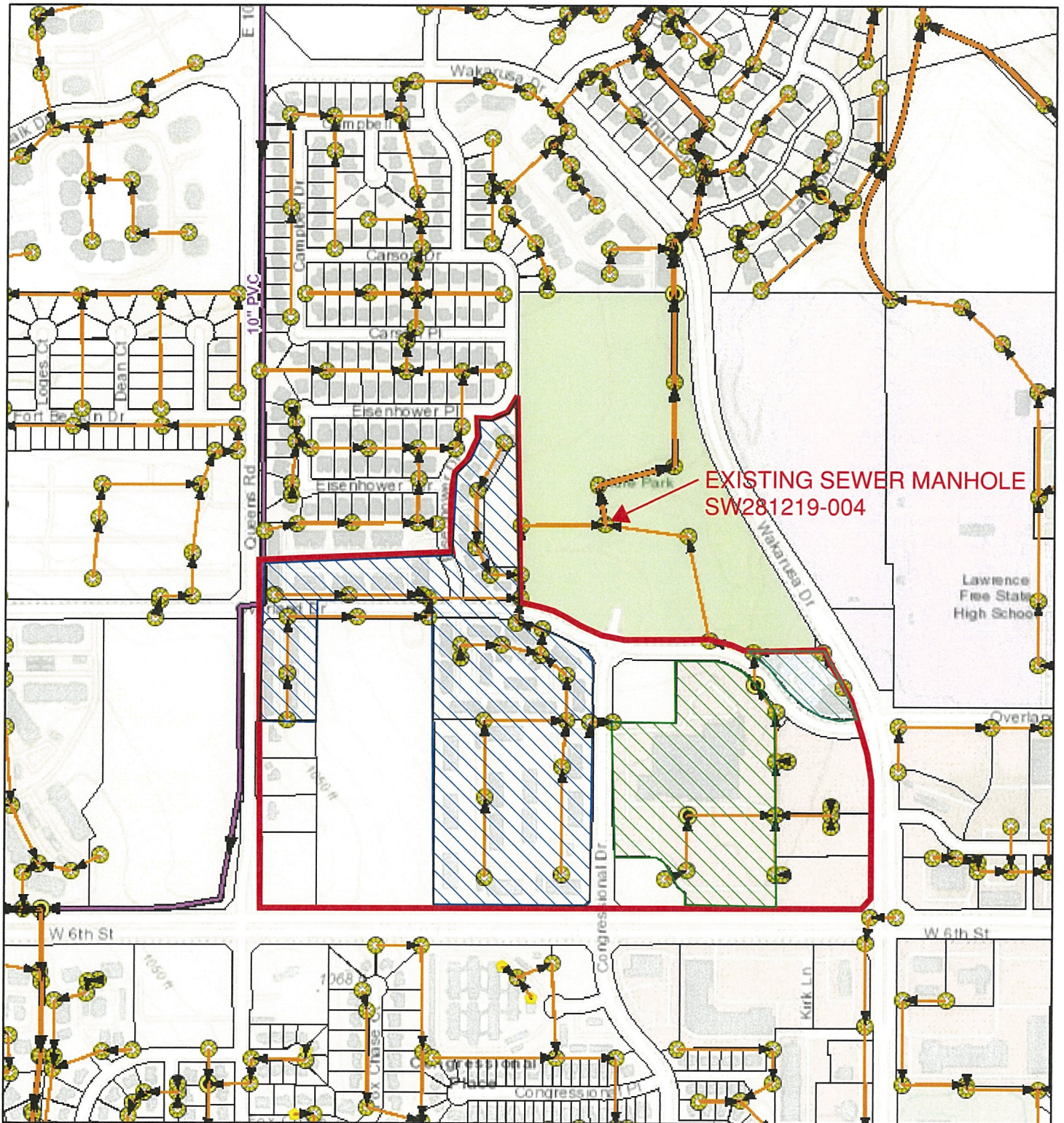
- LEGEND**
- DENOTES DRAINAGE FLOW-LINE
 - - - - DENOTES EXISTING CONTOUR
 - — — DENOTES PROPOSED CONTOUR
 - — — INDICATES EXISTING CONCRETE CURB & GUTTER
 - — — INDICATES PROPOSED CONCRETE CURB & GUTTER
 - FH FIRE HYDRANT
 - P PROPERTY LINE
 - W WATER LINE
 - SAN SANITARY LINE (PROP)
 - SAN SANITARY SEWER (EXIST)
 - STR STORM LINE
 - UP UNDERGROUND ELEC.
 - G GAS
 - T FIBER OPTIC SERVICE LINE
 - T UNDERGROUND TELEPHONE
 - DW DOMESTIC WATERLINE
 - FPL FIRE PROTECTION WATERLINE
 - RDN STORM SEWER ROOF DRAIN LINE
 - ADA DENOTES ADA PARKING SPACE

DEVELOPER AND OWNER:
 CITY OF LAWRENCE
 6 EAST 6TH STREET
 LAWRENCE, KS 66604
 ATTN: MELINDA K. HARGER
 PHONE: (785)832-7880
 EMAIL: MHARGER@LAWRENCEKS.ORG

ENGINEER:
 MCCLURE ENGINEERING CO.
 11250 CORPORATE AVENUE
 LENEXA, KANSAS 66219
 ATTN: TSMITH
 PHONE: (913) 888-7800
 FAX: (913) 888-7868
 EMAIL: TSMITH@MCERESULTS.COM



ArcGIS Web Map



1/21/2019 2:40:17 PM

1:9,028

0 0.05 0.1 0.2 mi

- | | | |
|-------------------|--------------------|------------------|
| ssPressurizedMain | Diversion | Split MH |
| ssGravityMain | ssManhole | KU or HINU MH |
| City Interceptor | Manhole | Private MH |
| City Collector | Drop MH | Private Lamphole |
| KU or HINU | Laphole | ssSewerTaps |
| Private | Flushing Structure | |

- tributary drainage area
- commercial use
- multi-family residential use

City of Lawrence, Kansas Utilities Department, Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS

Exhibit 2, Drainage Area Map

MUNICIPAL OFFICE

		OP JUSTICE CENTER	
		12400 FOSTER	
SF BLDG		74,497	
	*GPD	Month/Year	
	1,897	12/6/2007	
	2,000	11/6/2007	
	3,033	10/6/2007	
	17,323	9/6/2007	
	23,903	8/6/2007	
	23,276	7/6/2007	
	23,152	6/6/2007	
	18,100	5/6/2007	
	6,444	4/6/2007	
	2,176	3/6/2007	
	1,929	2/6/2007	
	1,828	1/6/2007	
	2,172	12/5/2007	
	2,219	11/5/2007	
	13,138	10/5/2007	
	16,000	9/5/2007	
	18,600	8/5/2007	
	25,533	7/5/2007	
AVG. GPD	2156.75		
GPD/1000 SF	28.95		

AVERAGE GPD PER 1000 SF OF BUILDING AREA =

28.95 GPD/1000SF

MINIMUM BASIS OF DESIGN

Pipe Size and Flow	TYPE OF DEVELOPMENT			
	Single Family	Multi-Family (Medium Density)	Multi-Family (High Density)	Commercial Industrial
8" - 18"	*Design Q 0.0046 cfs/acre **Actual Q 0.0058 cfs/acre	0.0084 0.0106	0.0139 0.0176	0.0077 0.0097
Larger than 18"	**Design Q 0.0046 ***Actual Q 0.0051	0.0084 0.0092	0.0139 0.0153	0.0077 0.0085

*Pipe to carry design flow at 0.67 depth of flow (see Item 2 below)
 **Pipe to carry design flow at 0.75 depth of flow (see Item 3 below)
 ***Actual Q = Full Pipe Flow

1. Assumptions include 100 gpcd, peak flow is 3 x Average Dry Weather Flow, minimum grades.

Single Family - 3-3.5 units/acre, 3 people/unit, 10 people/acre
 Multi-Family (Medium Density) - 4-5 units/acre, 3 people/unit, 18 people/acre
 Multi-Family (High Density) - 6-12 units/acre, 2.5 people/unit, 30 people/acre

Commercial - 5000 gpd/acre
 Industrial - 10,000 gpd/acre

2. Pipe size 8" - 18" to carry design flow at 0.67 depth of flow.

3. Pipe size larger than 18" to carry design flow at 0.75 depth of flow.

4. Example Calculation - Single Family, 8" - 18" sewers, pipe to carry design flow at 0.67 depth of flow, Design Q = 0.79 Actual Q (Full Pipe Flow).

$$Q \text{ Design} = \frac{100 \text{ gpcd} \times 10 \times 3.0 \times 1.547}{1,000,000} = 0.00464 \text{ cfs/acre}$$

$$Q \text{ Actual} = \frac{0.0046}{0.79} = 0.0058 \text{ cfs/acre}$$

Lawrence PD - Sanitary Sewer

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00640	ft/ft
Diameter	1.00	ft
Discharge	0.35	ft ³ /s

Results

Normal Depth	0.24	ft	←
Flow Area	0.14	ft ²	
Wetted Perimeter	1.02	ft	
Hydraulic Radius	0.14	ft	
Top Width	0.85	ft	
Critical Depth	0.24	ft	
Percent Full	23.6	%	
Critical Slope	0.00566	ft/ft	
Velocity	2.47	ft/s	←
Velocity Head	0.09	ft	
Specific Energy	0.33	ft	
Froude Number	1.06		
Maximum Discharge	3.07	ft ³ /s	
Discharge Full	2.85	ft ³ /s	
Slope Full	0.00010	ft/ft	
Flow Type	SuperCritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	23.65	%
Downstream Velocity	Infinity	ft/s